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(71) Applicant(s)
BP Australia Limited

(72) Inventor(s)
Mark Alexander Youden; Kenneth Stewart Murray

(74) Agent/Attorney
DAVIES COLLISON CAVE,1 Little Collins Street,MELBOURNE VIC 3000

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(71) Applicant *(for all designated States except US)*: BP AUSTRALIA LIMITED [AU/AU]; The Tower, Melbourne Central, 32nd floor, 360 Elizabeth Street, Melbourne, VIC 3000 (AU).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: YOUDEN, Mark, Alexander [AU/AU]; 1/19 Fenacre Street, Strathmore, VIC 3041 (AU). MURRAY, Kenneth, Stewart [GB/GB]; G.P.O. Box 5222BB, Melbourne, VIC 3001 (AU).

(74) Agents: HIND, Raymond, Stenton et al.; Davies Collison Cave, 1 Little Collins Street, Melbourne, VIC 3000 (AU).

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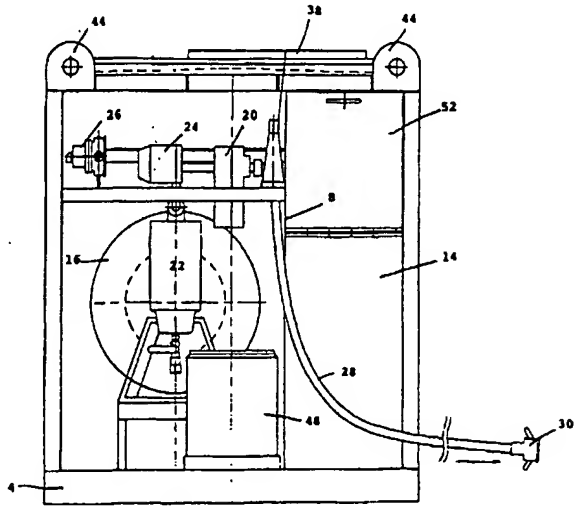

(57) Abstract

A mobile structural framework, liftable by crane or forklift truck, houses a pumping unit for refuelling aircraft at remote locations. The inlet of pump (20) is connected via hose (28) and coupling (30) to a fuel storage tank. The storage tank may be a separate mobile unit or alternatively both pump unit and storage tank may be incorporated in a mobile trailer. The pump (20) delivers fuel to an aircraft via a hose stored on reel (16). The pump is driven by a low voltage DC motor mounted within the housing of the pump. The power supply for the motor is storage batteries (not shown) carried by the unit behind fire wall (8). The batteries are rechargeable by solar panel (38) on the upper wall making the unit completely self-contained.

PUMPING UNIT

The present invention relates to a pumping unit and more particularly to a self-contained powered pumping unit for use in refuelling aircraft.

Conventionally, small aircraft at remove airfields or remote landing strips are refuelled using a hand pump mounted directly on a drum of aviation fuel. This method is also sometimes used when refuelling an aircraft at a remote location at a larger airfield without provision at that location for a powered refuelling facility.

According to the present invention, there is provided a self-contained pumping unit for use in refuelling aircraft comprising a transportable structure carrying a refuelling hose connected to an electrically-driven pump having an inlet for connection to a fuel storage tank, said structure also carrying electrical energy storage means for powering the pump, and at least one solar panel for recharging the storage means wherein the electrical energy storage means is mounted in the structure at one side of a fire wall which provides isolation from the pump and refuelling hose and wherein the pump inlet is connectable to a fuel storage tank which is separate from the unit, and the fire wall divides the interior of the module into front and rear compartments, the pump and refuelling hose being within the front compartment to which access is provided from the front and sides of the unit, and the storage means and associated control circuitry is mounted in the rear compartment to which access is provided only from the rear of the unit.

In one embodiment of the invention, the unit may consist of a module which can be transported by a crane or by a fork-lift, for use in conjunction with a separable fuel storage tank.

In another embodiment, the unit may be in the form of a trailer and may include a fuel storage tank, preferably incorporated in a control part of the trailer above tandem wheels of the trailer.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a front elevation of a pumping unit in accordance with one embodiment of the invention;

Fig. 2 is a view of the unit from one side;

Fig. 3 is a view of the unit from the opposite side;

Fig. 4 is a rear elevation of the pumping unit;

Fig.5 is a plan view of the pumping unit; and

Fig.6 is a schematic perspective view of a combined pumping and fuel storage unit in accordance with an embodiment of the invention.

As shown in Figures 1 to 5 of the accompanying drawings a self-contained, self-powered pumping unit for use in refuelling an aircraft at a remote location comprises a transportable support module 2 of cuboid shape consisting of a base platform 4 and superstructure comprising a frame supported by the base platform 4. The frame supports an upper wall 6 which lies above the base platform 4. The frame also carries an internal wall 8 which extends across the width of the module between the base platform 4 and upper wall 6 to divide the interior of the module into front and rear compartments 10,12. Side walls 14 extend rearwardly from the edges of the dividing wall 8 so that the rear compartment 12 is only open to, and accessible from, the rear of the module. The front compartment 10 of the module is accessible from the front and both sides of the module and remains generally open. The basic structure of the module including the base platform and top wall, the supporting framework and dividing walls is constructed of a suitable metal such as galvanised steel. The dividing wall 8 between the front and rear compartments 10,12 constitutes a fireproof wall to isolate the rear compartment 12 from the front compartment 10.

A reel 16 for a refuelling hose 18 is mounted in the front compartment 10, the reel 16 being connected to an electrically-driven pump 20 via a filter 22. The pump 20 is coupled to a meter 24 to record the amount of fuel delivered, and is controlled by an on-off switch 26 incorporated within a gas tight casing. The filter 22, pump 20, meter 24, and switch 26 are likewise mounted within the front compartment 10. The inlet to the pump 20 is coupled to an inlet hose 28 having at its outer end a suitable coupling 30 for connection to a corresponding coupling of a fuel storage tank. The tank itself may be incorporated as part of a separate transportable module. The coupling 30 at the outer end of the inlet hose 28 is of so-called dry break type incorporating a valve which automatically closes when the coupling is released from the mating coupling on the fuel storage tank.

The pump 20 is driven by a low voltage DC motor mounted within the housing of the pump. The power supply for the motor is provided by one or more rechargeable storage batteries 32 within the rear compartment 12 behind the fireproof dividing wall 8. The or each storage battery 32 is housed within a gas-tight enclosure 34 of box-like form having an openable lid 36 to provide access to the batteries, a suitable seal being provided between the lid 36 and body of the enclosure 34 to ensure gas tightness. The or each battery 32 is recharged by means of one or more solar panels 38 mounted on the top wall 6 of the module. The solar panel 38 is linked to the batteries 32 through appropriate control circuitry incorporated in a sealed control box 40 likewise mounted in the rear compartment 12 behind the fireproof dividing wall 8. Cables 42 extend from the control box 40 through the dividing wall 8 to the pump 20 and on-off switch 26. The cables 42 pass through gas-tight sealing glands in the dividing wall 8 in order to preserve isolation of the front compartment 10 from the rear compartment 12. The cables 42 are themselves of gas-tight construction.

The pumping unit thus described is self-contained with its own rechargeable power source incorporated within a module which is transportable and for this purpose the top of the module is provided with lugs 44 for attachment of a crane sling and the base platform 4 is provided with recesses 46 to receive the tines of a standard fork-lift truck. The pumping unit can thus be readily transported to a remote location to provide a powered refuelling facility for a aircraft in conjunction with a portable fuel storage tank. The storage batteries and electronic control circuitry are isolated behind the fireproof dividing wall from the pump and hoses in order to minimise the risk of fire if spillage or leakage should occur.

The module can also be used to carry ancillary items which may be needed in a refuelling operation. For example, a slops drum 48 and fire extinguisher may be mounted in the front compartment 10. One of the side walls 14 may carry an enclosure 50 closable by a door 52 for housing small items of equipment such as flasks and gloves, and also documents.

The embodiment shown in Figure 6 comprises a trailer 62 with tandem wheels 64 in its central part. A conventional towing hitch 66 extends from the front of the trailer 62. The main body of the trailer 62 comprises a base platform with side walls 68, and end walls 70. The body also carries superstructure consisting of an upper wall 72 which runs the length of the trailer parallel to the base platform.

A fuel storage tank 76 is mounted on the platform in the central part of the trailer so that it lies above the axes of the tandem wheels 64 whereby the balance of the trailer is not affected by varying amounts of fuel within the tank 76. By way of non-limiting example, the storage tank 76 may have a capacity of about 2,500 to 3,000 litres and is of a box-like construction. The tank 76 includes an inspection and filling hatch 78 in its upper wall.

An electrically-driven pump (not shown) is mounted in a rear compartment 80 of the trailer behind the fuel storage tank 76 together with a reel (not shown) for the refuelling hose and associated components such as filter, flow meter and on/off switch as described in connection with the embodiment of Figures 1 to 5. In this case however, the inlet to the pump is connected directly to the fuel storage tank 76 via suitable pipework. The pump is driven by a low voltage DC motor mounted within the pump housing and the power supply for the motor is provided by one or more rechargeable storage batteries (not shown) mounted within a front compartment 82 of the trailer forwardly of the fuel storage tank 76. The batteries are recharged by means of solar panels 86 via appropriate control circuitry, the solar panels 86 being carried by the upper wall 72 of the trailer above at least the rear and front compartments 80,82. The storage batteries are housed within a gas-tight enclosure corresponding to the enclosure 37 described above with an openable lid to provide access to the batteries and also with a suitable seal being provided to ensure gas tightness. The control circuitry is also incorporated in a sealed control box. A fireproof dividing wall 90 defines the rear end of the front compartment 82 and extends from the upper wall 72 of the trailer to the base platform of the trailer. The front compartment 82 is also closed at its opposite sides by fireproof side walls 92 extending forwardly from the wall 90 and extending

substantially up to the level of the upper wall 72, access to the compartment 82 being only via the front end of the trailer. Accordingly the front compartment 82 is substantially isolated from the fuel storage tank 76. Cables extend from the front compartment 82 to the rear compartment 80 through gas-tight sealing glands in the fireproof wall 90 in order to preserve the isolation of the front compartment 82 from the fuel storage tank 76 and rear compartment 80. The cables themselves are also of gas-tight construction. Accordingly, the storage batteries and electronic control circuitry are isolated behind the fireproof dividing wall 90 from the pump, hoses, and fuel storage tank in order to minimise the risk of fire if spillage or leakage should occur.

Preferably, the rear compartment 80 is itself isolated from the tank 76 by a dividing wall 94 which extends from the platform to the upper wall 72 to the base platform. The rear compartment 80 is preferably also closed at its opposite sides by walls extending rearwardly from the dividing wall 94, with access to the compartment 80 being only from the rear of the trailer.

The two dividing walls 90,94, together with the base platform and adjacent part of the trailer side walls 68, also define an enclosure for the tank 76. The tank enclosure is open to atmosphere at its top via an open structure formed within the upper wall 72 in the zone above the tank 76. The base portion of the tank enclosure forms a secondary entrainment tank 96 which surrounds the base part of the storage tank 76 in order to retain any fuel which may spill from the storage tank 76, for example during filling of the tank 76. A drain outlet leads from the secondary entrainment tank.

The trailer can also be used to carry ancillary items which may be needed in a refuelling operation, as described in our aforesaid application.

The pumping and fuel storage unit described herein can readily be transported by hitching the trailer to a towing coupling at the rear of a suitable vehicle to be thereby transported to an appropriate site on an airfield where

refuelling operations can take place. Although the trailer can carry a substantial amount of fuel in its fuel storage tank 76, the positioning of the tank 26 above the wheels 64 ensures that the stability of the trailer is retained irrespective of the amount of fuel held within the tank.

In an alternative embodiment (not shown) the pumping unit may be incorporated in a smaller trailer without a fuel storage tank, for use with a separate fuel storage tank.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A self-contained pumping unit for use in refuelling aircraft comprising a transportable structure carrying a refuelling hose connected to an electrically-driven pump having an inlet for connection to a fuel storage tank, said structure also carrying electrical energy storage means for powering the pump, and at least one solar panel for recharging the storage means wherein the electrical energy storage means is mounted in the structure at one side of a fire wall which provides isolation from the pump and refuelling hose and wherein the pump inlet is connectable to a fuel storage tank which is separate from the unit, and the fire wall divides the interior of the module into front and rear compartments, the pump and refuelling hose being within the front compartment to which access is provided from the front and sides of the unit, and the storage means and associated control circuitry is mounted in the rear compartment to which access is provided only from the rear of the unit.

2. A unit according to claim 1, wherein the structure comprises a base platform supporting superstructure including the fire wall and an upper wall, the solar panel being mounted on the upper wall.

3. A unit according to claims 1 or 2, wherein the structure comprises a framework which can be transported by being slung from a crane, or by engagement with the tines of a fork-lift truck.

4. A unit according to claims 1 or 2, wherein the structure forms part of a vehicle.

5. A unit according to claims 1 or 2, wherein the structure forms a trailer for attachment to a towing vehicle.

6. A unit according to claim 5, further comprising a fuel storage tank to which the inlet of the pump is connected.

7. A unit according to claim 6, wherein the trailer has tandem wheels and the storage tank is mounted above the axes of the wheels whereby to ensure that the balance of the trailer is preserved irrespective of the quantity of fuel within the storage tank.

8. A unit according to claim 7 when dependent on claim 2, wherein the storage tank is mounted at the other side of the fire wall.

9. A unit according to claim 8, wherein the tank is mounted within a central compartment of the trailer defined on one side by the fire wall and on the other side by a further dividing wall, said further dividing wall defining at the side remote from the tank a compartment in which the pump and refuelling hose is mounted.

10. A unit according to claim 9, wherein the central compartment defines a containment tank for containing any spills from the storage tank.

11. A unit according to claim 9 or claim 10, wherein the electrical energy storage means is mounted within a compartment of the trailer which is closed at both sides and is accessible only from an end of the trailer, and the compartment for the fuel storage tank is closed on both sides and is open at the top.

12. A unit according to any one of the preceding claims, wherein the electrical energy storage means consists of one or more storage batteries mounted within a gas-tight enclosure.

13. A unit according to any one of the preceding claims, wherein electrical connections between the electrical energy storage means and the pump is via at least one gas-tight electric cable extending through the fire wall via a gas-tight sealing gland.

14. A self-contained pumping unit, substantially as hereinbefore described with reference to the drawings.

DATED this 5th day of February, 1999

BP Australia Limited

By DAVIES COLLISON CAVE

Patent Attorneys for the Applicant

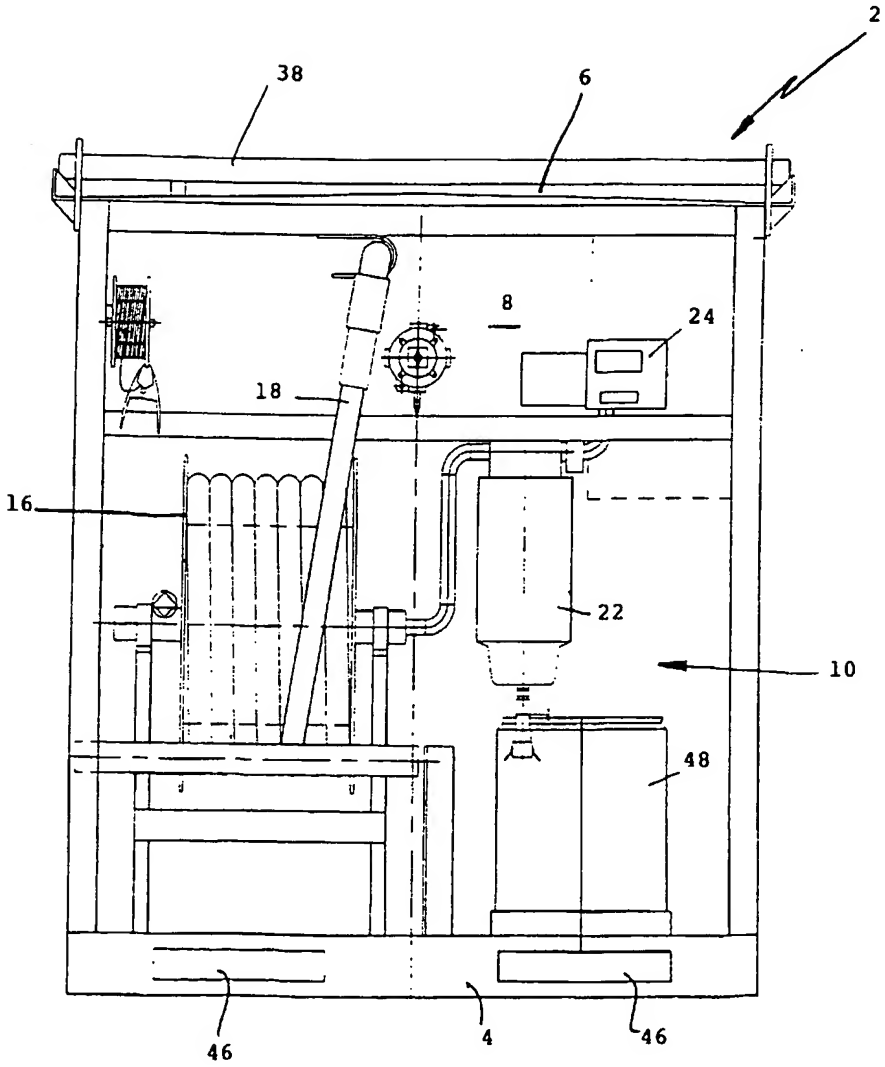

FIG. 1

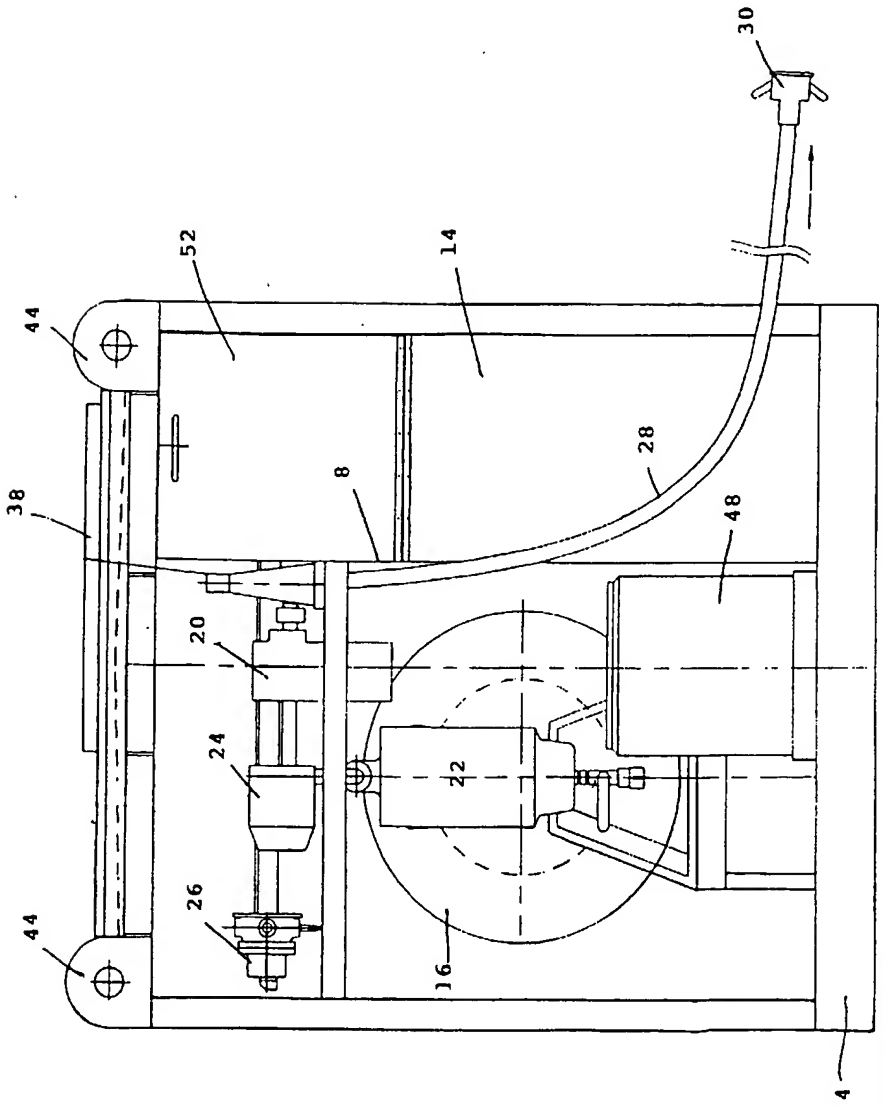

FIG. 2

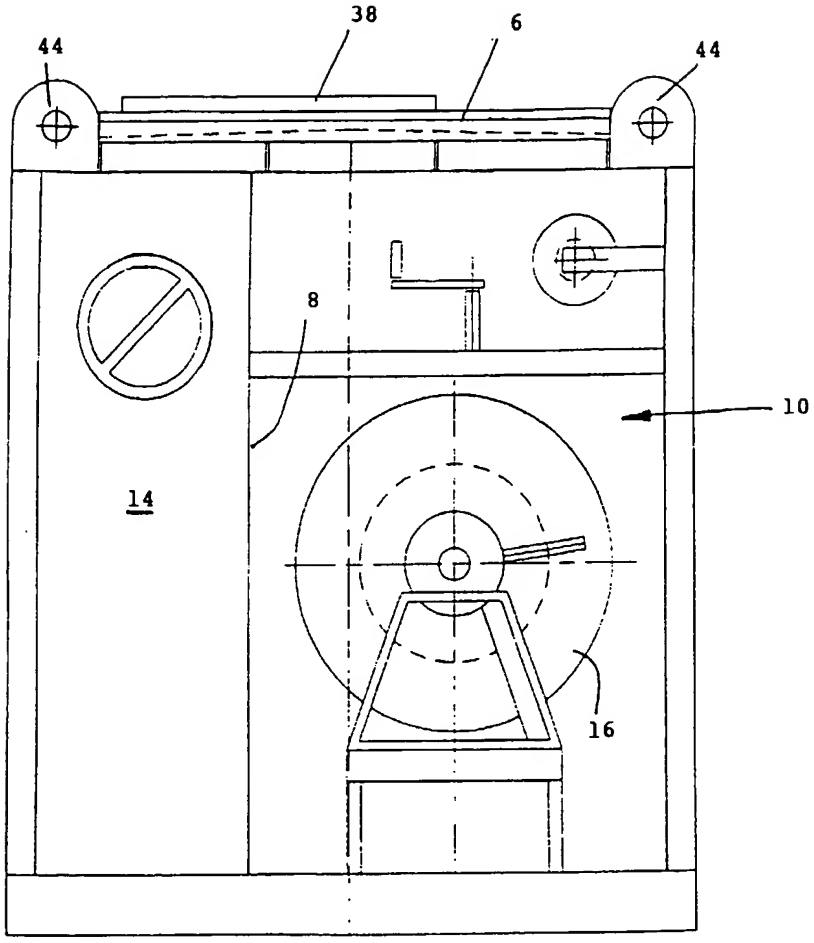

FIG. 3

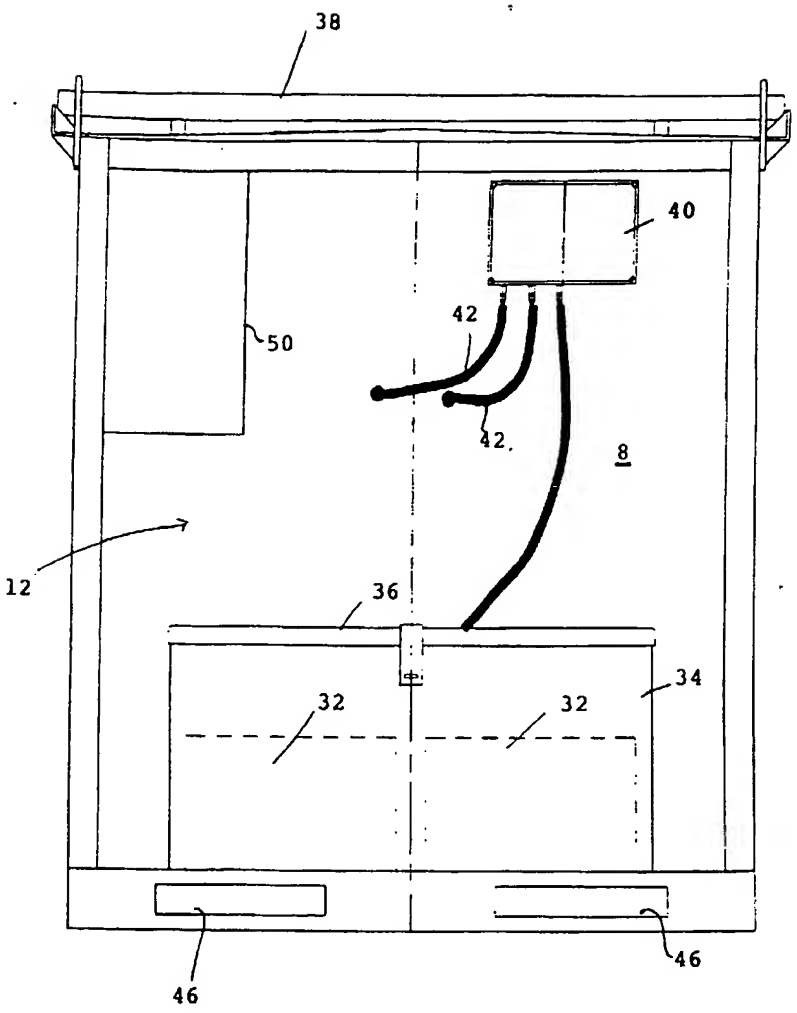

FIG. 4

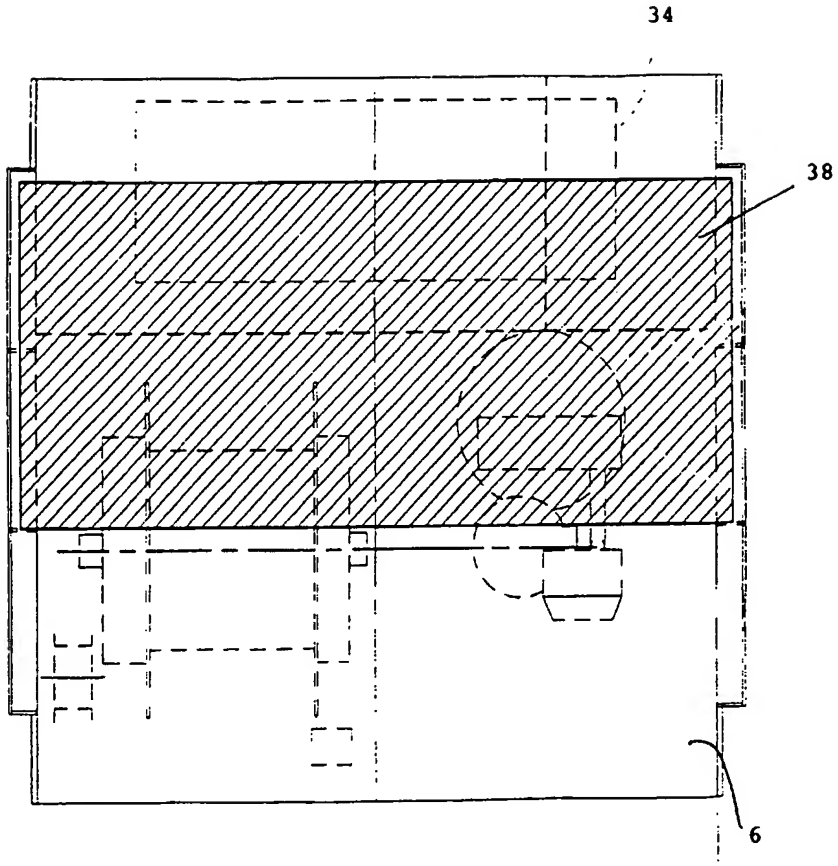

FIG 5

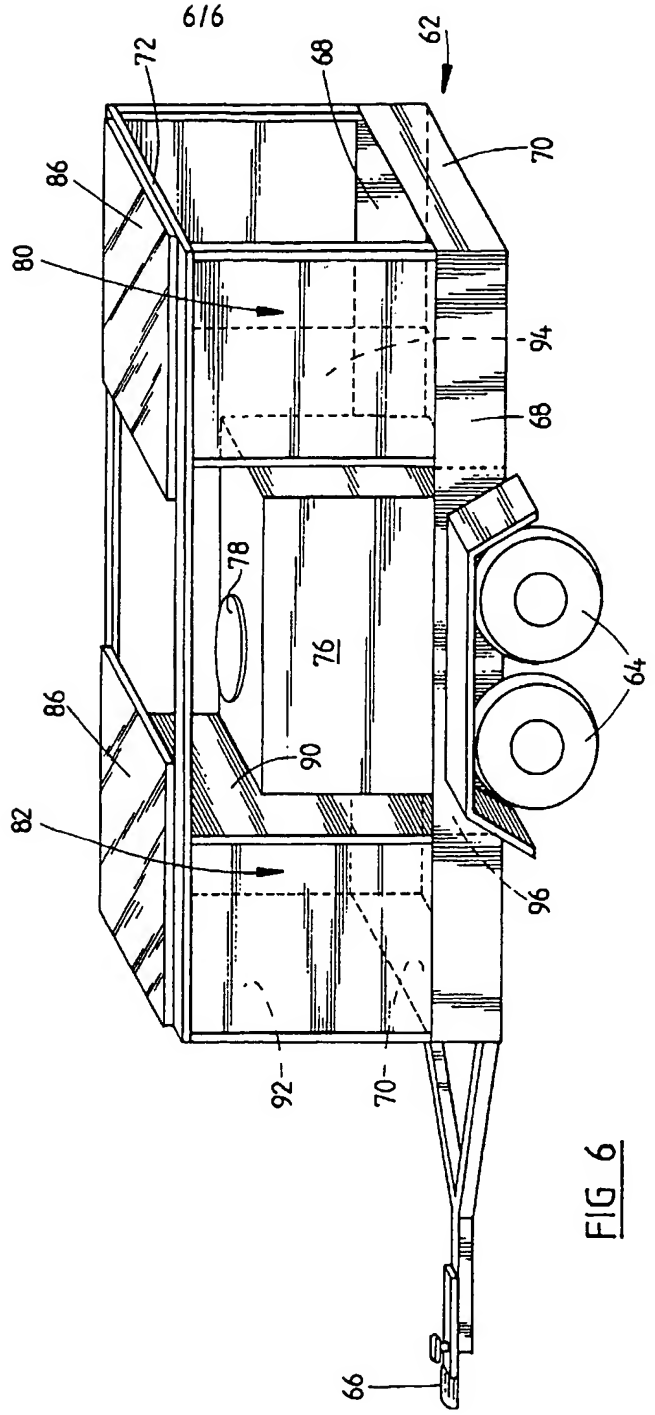

FIG 6

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